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(54) MALFUNCTION DETECTING METHOD FOR ACCELERATION SENSOR

(57)Abstract:

PURPOSE: To accurately detect the fault of an acceleration sensor even when running on any road surface by sensing the output fixture of the sensor and detecting the malfunction.

CONSTITUTION: A control unit 10 anti-skid controls based on the outputs of wheel speed sensors S1, S2, etc., when a malfunction occurs at an acceleration sensor 11. In this case, the output fixture of the sensor 11 is detected to detect its malfunction. That is, a vehicle body acceleration $A>a(g)$, output G of sensor $11<b(g)$, and (maximum wheel speed - minimum wheel speed) $<\Delta V$ (km/hr): a vehicle in which an anti-skid brake control is not conducted is running, where when the conditions in which a is a set numeric value in which the erroneous detection on a slope is considered, b is a numeric value slightly larger than the noise level of the sensor 11, ΔV is the numeric value indicating that at the time of generating the acceleration of the vehicle body acceleration A, no spin-up is conducted at the vehicle, not the time of turning, and no running on a slip road surface, are simultaneously continued for a predetermined time, the output fixture occurs at the sensor 11 to generate an alarm 12.
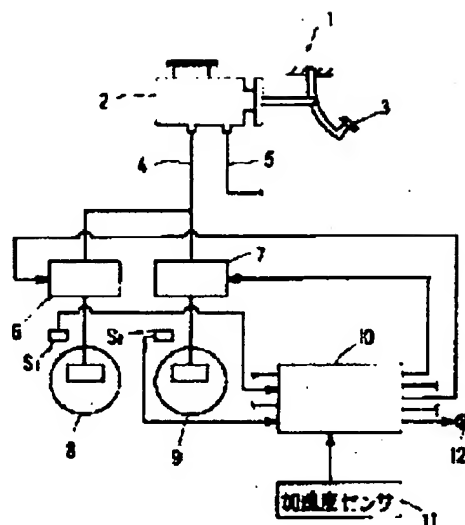
* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]Proofreading acceleration corresponding to an output of an acceleration sensor attached to the body of a car by which an antiskid control is carried out G, Body speed formed based on an output of a wheel speed sensor formed in two or more wheels V, When car body acceleration formed by differentiation of this body speed is set to A, a difference of top speed and the minimum speed should be smallness from predetermined speed-difference deltaV among wheel speed of a wheel of the 2nd specified acceleration b and the 1st (a) A> (specified acceleration a and b) G<(c) aforementioned plurality. (e) this car is [that the (d) antiskid control is not performed,] under run, As for a numerical value which said a set up in consideration of erroneous detection in a slope here, and the above-mentioned b, a slightly larger numerical value than a noise level of said acceleration sensor and the aforementioned deltaV do not perform a spin up for any of said wheel being at the time of acceleration generating of said A, An abnormality detecting method of an acceleration sensor which is a numerical value which shows that it is not at the revolution time, or not running a split road surface, and the above (a), (b), (c), (d), and (e) judge that abnormalities occurred simultaneously when it continued, predetermined time and.

[Claim 2]Proofreading acceleration corresponding to an output of an acceleration sensor attached to the body of a car by which an antiskid control is carried out G, Body speed formed based on an output of a wheel speed sensor formed in two or more wheels V, this – body speed – differentiation – forming – having – car body acceleration -- A -- having carried out – a case – (– a –) – G – > – the – one – specified acceleration – a – ' – (– b –) (G-A) – > – the – two – specified acceleration – b – ' – (– c –) – a difference of top speed and the minimum speed should be smallness from predetermined speed-difference deltaV' among wheel speed of two or more of said wheels. That the (d) antiskid control is not performed, (e) V>v', A numerical value which said a' set up here in consideration of erroneous detection in a slope of a maximum angle of inclination considered, An almost equal numerical value and aforementioned deltaV' do not perform [whether above-mentioned b' is equal to said a',] a spin up for any of said wheel being at the time of acceleration generating of said A, A numerical value which shows that it is not at the revolution time, or not running a split road surface, An abnormality detecting method of an acceleration sensor judged that said v' was the top speed of a car considered on a slope of a maximum angle of inclination, and in the above (a), (b), (c), (d), and (e) abnormalities generated it simultaneously when it continued, predetermined time and.

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]

[Industrial Application] This invention relates to the abnormality detecting method of an acceleration sensor.
[0002]

[Description of the Prior Art] Although it integrates with the output from the acceleration sensor attached to the body, it calculates and asks for presumed body speed and the antiskid-control device which performs an antiskid control using this body speed is known, When this acceleration sensor produces failure, acceleration of the body cannot be detected correctly, body speed cannot be presumed based on the output from that acceleration sensor, but there is a possibility of producing malfunction in an antiskid control. According to the fault detection device of an acceleration sensor given in JP,H1-195168,A, as a device for detecting whether in the former, such an acceleration sensor is out of order, for example. It is judged that this acceleration sensor is failure as the difference of the proofread acceleration value corresponding to the output of this acceleration sensor and the car body acceleration formed by the differentiation of the body speed formed based on the wheel speed of a car is beyond a predetermined value. Or it is judged that this acceleration sensor is failure as the difference of the body speed obtained by the integration of the acceleration proofread corresponding to the output of this acceleration sensor and the body speed obtained from the wheel speed sensor is beyond a predetermined value.

[0003] However, a car always does not run the flat ground, it may go up the slope of a big angle of inclination, may be gone down, or may run a low mu road side and a split road surface. In such a case, since these conditions are not taken into consideration with the above-mentioned device, there is a possibility of judging accidentally [be / it / failure].
[0004]

[Problem(s) to be Solved by the Invention] It aims at providing the abnormality detecting method of the acceleration sensor which can detect failure of an acceleration sensor correctly when this invention is made in view of an above-mentioned problem and it is running what kind of slope, or when running the road surface and split road surface of what kind of coefficient of friction.
[0005]

[Means for Solving the Problem] The above purpose proofreading acceleration corresponding to an output of an acceleration sensor attached to the body of a car by which an antiskid control is carried out G, Body speed

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PAGE 17/72 * RCVD AT 7/22/2010 4:28:19 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/34 * DNIS:2732885 * CSID:9198061690 * DURATION (mm-ss):22-02

formed based on an output of a wheel speed sensor formed in two or more wheels V, When car body acceleration formed by differentiation of this body speed is set to A, a difference of top speed and the minimum speed should be smallness from predetermined speed-difference deltaV among wheel speed of a wheel of the 2nd specified acceleration b and the 1st (a) A> (specified acceleration a and b) G<(c) aforementioned plurality. (e) this car is [that the (d) antiskid control is not performed,] under run, As for a numerical value which said a set up in consideration of erroneous detection in a slope here, and the above-mentioned b, a slightly larger numerical value than a noise level of said acceleration sensor and the aforementioned deltaV do not perform a spin up for any of said wheel being at the time of acceleration generating of said A, It is a numerical value which shows that it is not at the revolution time, or not running a split road surface, and, therefore, the above (a), (b), (c), (d), and (e) are attained simultaneously, without predetermined time and an abnormality detecting method of an acceleration sensor judged that abnormalities occurred when it continued.

[0006]The above purpose proofreading acceleration corresponding to an output of an acceleration sensor attached to the body of a car by which an antiskid control is carried out G, Body speed formed based on an output of a wheel speed sensor formed in two or more wheels V, this -- body speed -- differentiation -- forming -- having -- car body acceleration -- A -- having carried out -- a case -- (-- a --) -- G -- > -- the -- one -- specified acceleration -- a -- ' -- (-- b --) (G-A) -- > -- the -- two -- specified acceleration -- b -- ' -- (-- c --) -- a difference of top speed and the minimum speed should be smallness from predetermined speed-difference deltaV' among wheel speed of two or more of said wheels. That the (d) antiskid control is not performed, (e) V>v', A numerical value which said a' set up here in consideration of erroneous detection in a slope of a maximum angle of inclination considered, An almost equal numerical value and aforementioned deltaV' do not perform [whether above-mentioned b' is equal to said a',] a spin up for any of said wheel being at the time of acceleration generating of said A, A numerical value which shows that it is not at the revolution time, or not running a split road surface, Said v' is the top speed of a car considered on a slope of a maximum angle of inclination, and, therefore, the above (a), (b), (c), (d), and (e) are attained simultaneously, without an abnormality detecting method of predetermined time and an acceleration sensor judged that abnormalities occurred when it continued.

[0007]

[Function]According to the invention of Claim 1, although an acceleration sensor receives the power by the 1st specified acceleration a with gravity on the slope where an angle of inclination is large enough, conditions (a) the car body acceleration formed based on the wheel speed sensor, By being smallness from this by making into the 2nd specified acceleration a value with this slightly larger car body acceleration than the noise level which can consider that it is size and the output of this acceleration sensor from this 1st specified acceleration a in consideration of this, Clearly, the output of this acceleration sensor has adhered, or judge that they are the abnormalities of an output gain, and further, from speed-difference deltaV predetermined in the highest wheel speed-minimum wheel speed, if the number of these cars is four by being smallness, It is carried out on condition that at least one flower cannot be found [that it is not this car at the revolution time, not running the split road surface, and] in a locked position. By furthermore not performing the antiskid control, the difference of body speed and wheel speed is not large, Since the time when all of these conditions are filled on condition that it is actually running exceeds predetermined time, the output of an

acceleration sensor has adhered or it detects that they are the abnormalities of an output gain. Therefore, when this car is running what kind of road surface, certainly, the output of that acceleration sensor has adhered or it is detected that they are the abnormalities of an output gain.

[0008]In the invention of Claim 2, from 1st specified acceleration a', although the output by which the acceleration sensor was proofread is size, This a' is the minimum value defined in consideration of the maximum angle of the angle of inclination considered on the slope this car runs, It is equal to this, or **** etc. are by carrying out, and acceleration is the 2nd specified acceleration b', Having caused abnormalities clearly to the output gain or output drift of this acceleration sensor, since the difference of the output by which the acceleration sensor was proofread, and the car body acceleration formed from wheel speed is larger than this is detected, When the difference of the highest wheel speed and the minimum wheel speed is smallness from deltaV', it is not like the invention of Claim 1 at the revolution time, The speed in the highest angle of inclination he is trying to detect abnormalities a condition [not running the split road surface etc.], and can moreover consider the speed of a car is size from predetermined speed v', It carries out, if the state where the conditions of a more than including this are fulfilled simultaneously continues exceeding predetermined time when this car will run what kind of road surface, and on condition that an antiskid control is not carried out. Therefore, this is certainly detectable if the output gain or output drift of this acceleration sensor has abnormalities.

[0009]

[Example]Hereafter, the abnormality detecting method of the acceleration sensor by working example of this invention is explained with reference to Drawings.

[0010]Although drawing 1 shows the piping system of the antiskid-control device with which this invention is applied, In a figure, an antiskid-control device is shown by 1 as a whole, and generates fluid pressure in the two fluid pressure generating rooms by breaking the brake pedal 3 into the master cylinder 2, respectively, and this supplies fluid pressure to the wheel cylinder of the wheel of each system via the pipelines 4 and 5. Since it is the composition, if only one pipeline 4 is explained, if it is X piping, fluid pressure will be supplied to the wheel cylinder of the front right wheel 8, and the wheel cylinder of the rear left wheel 9 via the electromagnetism actuators 6 and 7 which consist of a 3 position solenoid operated directional control valve, for example. These are approached, respectively and wheel speed sensor S_1 and S_2 are provided in them.

These outputs are supplied to the control unit 10.

Furthermore, according to this invention, the output of the acceleration sensor 11 is supplied.

[0011]The permanent magnet which the acceleration sensor 11 mainly has two types so that it may be publicly known, and was supported rockable in response to the acceleration of a car, There are what consists of a Hall device which detects this movement, and a thing which detects acceleration in the middle by change of the electric capacity between the electrode plates allocated on a movable electrode plate and these both sides according to the acceleration of a car. This invention is applicable to any type.

[0012]The control unit 10 is constituted like the former and ****, and Wheel speed sensor S_1, In response to the output of S_2, S_3, and S_4 (wheel speed sensor formed by two next persons approaching the wheel of other systems), the skid state of the wheels 8 and 9 and other wheels is evaluated, This controls the

electromagnetism actuators 6 and 7 (only one system is explained hereafter), and he falls and holds and is trying to make the fluid pressure of the wheel cylinder of the wheels 8 and 9 increase. Although used for the output of the acceleration sensor 11 detecting the acceleration of the body, the presumed speed of the body may be obtained, and he undergoes the output of wheel speed sensor S_1 - S_4 like a conventional example

also in this example, and is trying to calculate body speed by integrating with this. Although car body acceleration is obtained by differentiating this body speed, When abnormalities arise in this, based on the output of wheel speed sensor S_1 - S_4, it is made to perform an antiskid control with an algorithm which also

receives the output of the acceleration sensor 11 in the control unit 10, and is mentioned later. Of course, if the acceleration sensor 11 is normal, it is most exact to calculate body speed by making this output into car body acceleration, and differentiating this, but. If the antiskid control is carried out only by this, when abnormalities arise in an acceleration sensor, promptly, an antiskid control becomes impossible and is dangerous.

[0013]When the acceleration sensor 11 is made unusual so that it may furthermore mention later, he is trying to drive the alarm 12 according to this example.

[0014]Next, the abnormality detecting method of the acceleration sensor by working example of this invention is explained.

[0015]According to the 1st working example of this invention, although he is trying for output adherence detection to detect the abnormalities of an acceleration sensor, this detection condition is as follows. Output G<b[of the car-body-acceleration A>a(g) ** acceleration sensor 11] (g) ** and a carrying-out-<(fastest wheel speed-minimum wheel speed) deltaV(km/h) **ABS (antiskid brake) control ** vehicle are running, And the alarm 12 is driven noting that output adherence will arise in the acceleration sensor 11, if the above conditions carry out predetermined time continuation.

[0016]Next, each of the above-mentioned conditions is explained in detail.

[0017]As having presupposed that the car body acceleration A becomes from a (g) in size is shown in drawing 2, although the car 20 may run not only in the flat ground but the slope 21, the relation which is [which moves forward so that this slope may be illustrated / or or] between car body acceleration and the output of an acceleration sensor by whether it goes astern is obtained. That is, the car body acceleration A is the car body acceleration obtained when the control unit 10 calculated this in response to the output of wheel speed sensor S_1 - S_4, and the acceleration sensor output G is the acceleration proofread from the output of

the acceleration sensor 11 corresponding to this. Although a linear predetermined relation is obtained between the car body acceleration A and the proofreading output G of an acceleration sensor as the acceleration sensor 11 is normal, such a relation is not obtained if the output has adhered. In order to detect this, although the car body acceleration A is size and the output G of the acceleration sensor 11 made it smaller than b (g), from a (g), Since acceleration has already acted as gravitational acceleration even if a car stops on a slope, though the acceleration sensor 11 of which type is used, on a downward slope, a relation changes according to the angle theta of a slope, and a relation changes according to the angle theta of a slope also on an uphill. That is, in consideration of the posture of a car, and the setting angle of an acceleration sensor, the car body acceleration A supposes that it is size from a (g). Of course, it is good though it is size from this a (g) depending on conditions. Although it is common that the characteristic of

acceleration.sensor 11 the very thing or this service voltage has level fluctuation, and there is what is called a certain noise level as for the output G of the acceleration sensor 11 having considered it as smallness from b (g), in consideration of this, it is considered as smallness from b (g). That is, by saying that it is still smallness from b (g) with the proofreading acceleration to which the output of the acceleration sensor 11 corresponds, since the car body acceleration A has come out in more than a (g), it is judged that the abnormalities in adherence are caused. In furthermore (the highest wheel speed-minimum wheel speed) being smallness from deltaV (km/h) circle [this car], i.e., when circling, about a hand of cut, in an outside front wheel, wheel speed becomes large most, and, in an inside rear wheel, wheel speed becomes small most. It is because exact body speed cannot be obtained now, or is because the speed difference arises for the revolving speed of the wheel by the side of low mu, and the wheel by the side of high mu and exact body speed cannot be calculated now, when running the split road surface. Or it is a numerical value which shows that the spin up has not arisen they to be [any of a wheel]. It is also the same Reason as the above that it furthermore is not during ABS control, and it is because which wheel's having been in the locked position or a lock tendency is shown, so wheel speed empty vehicle object speed cannot be calculated now correctly to carry out ABS control. Although that it is under run requires that the car should actually run, The control unit 10 has always received the signal of wheel speed sensor S_1 - S_4, and by this time change, this may be body speed >0, even if wheel speed is set to 0 (this reverse also occurring), and it can judge whether this car is running. The time which has occurred simultaneously counts up all the above conditions exceeding predetermined time, and he judges that they are the abnormalities of the acceleration sensor 11 by output adherence, and is trying to emit an alarm.

[0018]Next, the abnormality detecting method by the 2nd working example of the acceleration sensor 11 is explained. In this case, the acceleration G which proofread the output of the acceleration sensor 11 is size from a' (g), (Acceleration by which output of this acceleration sensor 11 was proofread) - (car body acceleration calculated from wheel speed sensor S_1-S_4) is size from a' (g), The (highest wheel speed-minimum wheel speed) is smallness from deltaV' (km/h), If that ABS control is not performed, the body speed's V being size from v' (km/h), and such conditions continue exceeding the 2nd predetermined time simultaneously, it will be judged that abnormalities arose in the output gain or output drift of the acceleration sensor 11.

[0019]Next, these monograph affair is explained.

[0020]As shown in drawing 2, when the car 20 is running the slope, since gravitational acceleration works to this center-of-gravity G_0, though the car 20 has stopped, acceleration has already worked, but that the output G of the acceleration sensor 11 (it is hereafter considered as calibration value) considered it as size from a' (g). When it is made more than the highest angle theta expected in consideration of this point, it is equivalent to size from a' (g), and the output A of the car-body-acceleration sensor supposes that size will become from a' (g). It is because it is shown that (the car body acceleration calculated from the output-wheel speed of this acceleration sensor 11) is size, and its output gain of the acceleration sensor 11 is clearly more unusual than this a' (g) even if the car body acceleration made larger than a' (g) is the minimum 0. In order to judge whether they are furthermore right conditions, the highest wheel speed-minimum wheel speed is the same Reason as it being smallness and this mentioned above from deltaV' (km/h). It is the same in having

mentioned not controlling ABS and this above. The vehicle speed V thinks that that it is size measures the above steep hills at a counter by making V (km/h) into top speed by constant-speed run, and it does not run the steep hills more than the 2nd predetermined time from v' (km/h), and is defined.

[0021]Although the case where the output of an acceleration sensor becomes a normal straight line at the time of taking car body acceleration along a horizontal axis, and taking the output of an acceleration sensor along a vertical axis, and an inclination becomes large from this so much, or it has become small is made unusual [an output gain] in this invention, Thereby, the change from zero point which is hard to permit is also detectable. These can be coped with although the abnormalities of a gain are produced from the layer short circuit of the output line of service voltage change or the acceleration sensor 11.

[0022]Could detect the abnormalities of the acceleration sensor correctly, according to the method by working example of this invention, as stated above, when having run the slope and abnormalities were produced in an acceleration sensor like before, there was a case so that this may not be made unusual, but. Also when reverse, it was, but such an incorrect check can be prevented certainly.

[0023]As mentioned above, although each working example of this invention was described, of course based on the technical conception of this invention, various modification is possible.

[0024]For example, although size and the (acceleration sensor output G-car body acceleration A) made the output G of the acceleration sensor 11 larger than a' (g) from a' (g) in an output adherence detection condition and output gain malfunction detection in the above working example, it is good also as latter >(G-A) b' (a'!=b'). That is, it may change in consideration of the attachment conditions over the conditions and the body a car runs.

[0025]
[Effect of the Invention]As stated above, according to the abnormality detecting method of the acceleration sensor of this invention, even when a vehicle runs what kind of road surface, the abnormalities of an acceleration sensor can be detected promptly certainly.

[Translation done.]

TECHNICAL FIELD

[Industrial Application]This invention relates to the abnormality detecting method of an acceleration sensor.

EFFECT OF.THE INVENTION

[Effect of the Invention]As stated above, according to the abnormality detecting method of the acceleration sensor of this invention, even when a vehicle runs what kind of road surface, the abnormalities of an acceleration sensor can be detected promptly certainly.

TECHNICAL PROBLEM

[Description of the Prior Art]Although it integrates with the output from the acceleration sensor attached to the body, it calculates and asks for presumed body speed and the antiskid-control device which performs an antiskid control using this body speed is known, When this acceleration sensor produces failure, acceleration of the body cannot be detected correctly, body speed cannot be presumed based on the output from that acceleration sensor, but there is a possibility of producing malfunction in an antiskid control. According to the fault detection device of an acceleration sensor given in JP,H1-195168,A, as a device for detecting whether in the former, such an acceleration sensor is out of order, for example. It is judged that this acceleration sensor is failure as the difference of the proofread acceleration value corresponding to the output of this acceleration sensor and the car body acceleration formed by the differentiation of the body speed formed based on the wheel speed of a car is beyond a predetermined value. Or it is judged that this acceleration sensor is failure as the difference of the body speed obtained by the integration of the acceleration proofread corresponding to the output of this acceleration sensor and the body speed obtained from the wheel speed sensor is beyond a predetermined value.

[0003]However, a car always does not run the flat ground, it may go up the slope of a big angle of inclination, may be gone down, or may run a low mu road side and a split road surface. In such a case, since these conditions are not taken into consideration with the above-mentioned device, there is a possibility of judging accidentally [be / it / failure].

MEANS

[Means for Solving the Problem]The above purpose proofreading acceleration corresponding to an output of an acceleration sensor attached to the body of a car by which an antiskid control is carried out G, Body speed formed based on an output of a wheel speed sensor formed in two or more wheels V, When car body acceleration formed by differentiation of this body speed is set to A, a difference of top speed and the minimum speed should be smallness from predetermined speed-difference deltaV among wheel speed of a wheel of the 2nd specified acceleration b and the 1st (a) A> (specified acceleration a and b) G<(c) aforementioned plurality. (e) this car is [that the (d) antiskid control is not performed,] under run, As for a numerical value which said a set up in consideration of erroneous detection in a slope here, and the above-mentioned b, a slightly larger numerical value than a noise level of said acceleration sensor and the aforementioned deltaV do not perform a spin up for any of said wheel being at the time of acceleration generating of said A, It is a numerical value which shows that it is not at the revolution time, or not running a split road surface, and, therefore, the above (a), (b), (c), (d), and (e) are attained simultaneously, without predetermined time and an abnormality detecting method of an acceleration sensor judged that abnormalities occurred when it continued.

[0006]The above purpose proofreading acceleration corresponding to an output of an acceleration sensor attached to the body of a car by which an antiskid control is carried out G, Body speed formed based on an output of a wheel speed sensor formed in two or more wheels V, this -- body speed -- differentiation -- forming -- having -- car body acceleration -- A -- having carried out -- a case -- (-- a --) -- G -- > -- the -- one -- specified acceleration -- a -- ' -- (-- b --) (G-A) -- > -- the -- two -- specified acceleration -- b -- ' -- (-- c --) -- a difference of top speed and the minimum speed should be smallness from predetermined speed-difference deltaV' among wheel speed of two or more of said wheels. That the (d) antiskid control is not performed, (e) V>v', A numerical value which said a' set up here in consideration of erroneous detection in a slope of a maximum angle of inclination considered, An almost equal numerical value and aforementioned deltaV' do not perform [whether above-mentioned b' is equal to said a',] a spin up for any of said wheel being at the time of acceleration generating of said A, A numerical value which shows that it is not at the revolution time, or not running a split road surface, Said v' is the top speed of a car considered on a slope of a maximum angle of inclination, and, therefore, the above (a), (b), (c), (d), and (e) are attained simultaneously, without an abnormality detecting method of predetermined time and an acceleration sensor judged that abnormalities occurred when it continued.

OPERATION

[Function]According to the invention of Claim 1, although an acceleration sensor receives the power by the 1st specified acceleration a with gravity on the slope where an angle of inclination is large enough, conditions (a) the car body acceleration formed based on the wheel speed sensor, By being smallness from this by making into the 2nd specified acceleration a value with this slightly larger car body acceleration than the noise level which can consider that it is size and the output of this acceleration sensor from this 1st specified acceleration a in consideration of this, Clearly, the output of this acceleration sensor has adhered, or judge that they are the abnormalities of an output gain, and further, from speed-difference deltaV predetermined in the highest wheel speed-minimum wheel speed, if the number of these cars is four by being smallness, It is carried out on condition that at least one flower cannot be found [that it is not this car at the revolution time, not running the split road surface, and] in a locked position. By furthermore not performing the antiskid control, the difference of body speed and wheel speed is not large, Since the time when all of these conditions are filled on condition that it is actually running exceeds predetermined time, the output of an acceleration sensor has adhered or it detects that they are the abnormalities of an output gain. Therefore, when this car is running what kind of road surface, certainly, the output of that acceleration sensor has adhered or it is detected that they are the abnormalities of an output gain.

[0008]In the invention of Claim 2, from 1st specified acceleration a', although the output by which the acceleration sensor was proofread is size, This a' is the minimum value defined in consideration of the maximum angle of the angle of inclination considered on the slope this car runs, It is equal to this, or **** etc. are by carrying out, and acceleration is the 2nd specified acceleration b', Having caused abnormalities clearly to the output gain or output drift of this acceleration sensor, since the difference of the output by which the acceleration sensor was proofread, and the car body acceleration formed from wheel speed is larger than this is detected, When the difference of the highest wheel speed and the minimum wheel speed is smallness from deltaV', it is not like the invention of Claim 1 at the revolution time, The speed in the highest angle of inclination he is trying to detect abnormalities a condition [not running the split road surface etc.], and can moreover consider the speed of a car is size from predetermined speed v', It carries out, if the state where the conditions of a more than including this are fulfilled simultaneously continues exceeding predetermined time when this car will run what kind of road surface, and on condition that an antiskid control is not carried out. Therefore, this is certainly detectable if the output gain or output drift of this acceleration sensor has abnormalities.

EXAMPLE

[Example]Hereafter, the abnormality detecting method of the acceleration sensor by working example of this invention is explained with reference to Drawings.

[0010]Although drawing 1 shows the piping system of the antiskid-control device with which this invention is applied, In a figure, an antiskid-control device is shown by 1 as a whole, and generates fluid pressure in the two fluid pressure generating rooms by breaking the brake pedal 3 into the master cylinder 2, respectively, and this supplies fluid pressure to the wheel cylinder of the wheel of each system via the pipelines 4 and 5. Since it is the composition, if only one pipeline 4 is explained, if it is X piping, fluid pressure will be supplied to the wheel cylinder of the front right wheel 8, and the wheel cylinder of the rear left wheel 9 via the electromagnetism actuators 6 and 7 which consist of a 3 position solenoid operated directional control valve, for example. These are approached, respectively and wheel speed sensor S_1 and S_2 are provided in them. These outputs are supplied to the control unit 10.

Furthermore, according to this invention, the output of the acceleration sensor 11 is supplied.

[0011]The permanent magnet which the acceleration sensor 11 mainly has two types so that it may be publicly known, and was supported rockable in response to the acceleration of a car, There are what consists of a Hall device which detects this movement, and a thing which detects acceleration in the middle by change of the electric capacity between the electrode plates allocated on a movable electrode plate and these both sides according to the acceleration of a car. This invention is applicable to any type.

[0012]The control unit 10 is constituted like the former and ****, and Wheel speed sensor S_1, In response to the output of S_2, S_3, and S_4 (wheel speed sensor formed by two next persons approaching the wheel of other systems), the skid state of the wheels 8 and 9 and other wheels is evaluated, This controls the electromagnetism actuators 6 and 7 (only one system is explained hereafter), and he falls and holds and is trying to make the fluid pressure of the wheel cylinder of the wheels 8 and 9 increase. Although used for the output of the acceleration sensor 11 detecting the acceleration of the body, the presumed speed of the body may be obtained, and he undergoes the output of wheel speed sensor S_1 - S_4 like a conventional example also in this example, and is trying to calculate body speed by integrating with this. Although car body acceleration is obtained by differentiating this body speed, When abnormalities arise in this, based on the output of wheel speed sensor S_1 - S_4, it is made to perform an antiskid control with an algorithm which also receives the output of the acceleration sensor 11 in the control unit 10, and is mentioned later. Of course, if the acceleration sensor 11 is normal, it is most exact to calculate body speed by making this output into car body acceleration, and differentiating this, but. If the antiskid control is carried out only by this, when abnormalities arise in an acceleration sensor, promptly, an antiskid control becomes impossible and is dangerous.

[0013]When the acceleration sensor 11 is made unusual so that it may furthermore mention later, he is trying to drive the alarm 12 according to this example.

[0014]Next, the abnormality detecting method of the acceleration sensor by working example of this invention is explained.

[0015]According to the 1st working example of this invention, although he is trying for output adherence

detection to detect the abnormalities of an acceleration sensor, this detection condition is as follows. Output G<b[of the car-body-acceleration A>a(g) ** acceleration sensor 11] (g) ** and a carrying-out-<(fastest wheel speed-minimum wheel speed) deltaV(km/h) **ABS (antiskid brake) control ** vehicle are running, And the alarm 12 is driven noting that output adherence will arise in the acceleration sensor 11, if the above conditions carry out predetermined time continuation.

[0016]Next, each of the above-mentioned conditions is explained in detail.

[0017]As having presupposed that the car body acceleration A becomes from a (g) in size is shown in drawing 2, although the car 20 may run not only in the flat ground but the slope 21, the relation which is [which moves forward so that this slope may be illustrated / or or] between car body acceleration and the output of an acceleration sensor by whether it goes astern is obtained. That is, the car body acceleration A is the car body acceleration obtained when the control unit 10 calculated this in response to the output of wheel speed sensor S_1 - S_4, and the acceleration sensor output G is the acceleration proofread from the output of the acceleration sensor 11 corresponding to this. Although a linear predetermined relation is obtained between the car body acceleration A and the proofreading output G of an acceleration sensor as the acceleration sensor 11 is normal, such a relation is not obtained if the output has adhered. In order to detect this, although the car body acceleration A is size and the output G of the acceleration sensor 11 made it smaller than b (g), from a (g), Since acceleration has already acted as gravitational acceleration even if a car stops on a slope, though the acceleration sensor 11 of which type is used, on a downward slope, a relation changes according to the angle theta of a slope, and a relation changes according to the angle theta of a slope also on an uphill. That is, in consideration of the posture of a car, and the setting angle of an acceleration sensor, the car body acceleration A supposes that it is size from a (g). Of course, it is good though it is size from this a (g) depending on conditions. Although it is common that the characteristic of acceleration sensor 11 the very thing or this service voltage has level fluctuation, and there is what is called a certain noise level as for the output G of the acceleration sensor 11 having considered it as smallness from b (g), in consideration of this, it is considered as smallness from b (g). That is, by saying that it is still smallness from b (g) with the proofreading acceleration to which the output of the acceleration sensor 11 corresponds, since the car body acceleration A has come out in more than a (g), it is judged that the abnormalities in adherence are caused. In furthermore (the highest wheel speed-minimum wheel speed) being smallness from deltaV (km/h) circle [this car], i.e., when circling, about a hand of cut, in an outside front wheel, wheel speed becomes large most, and, in an inside rear wheel, wheel speed becomes small most. It is because exact body speed cannot be obtained now, or is because the speed difference arises for the revolving speed of the wheel by the side of low mu, and the wheel by the side of high mu and exact body speed cannot be calculated now, when running the split road surface. Or it is a numerical value which shows that the spin up has not arisen they to be [any of a wheel]. It is also the same Reason as the above that it furthermore is not during ABS control, and it is because which wheel's having been in the locked position or a lock tendency is shown, so wheel speed empty vehicle object speed cannot be calculated now correctly to carry out ABS control. Although that it is under run requires that the car should actually run, The control unit 10 has always received the signal of wheel speed sensor S_1 - S_4, and by this time change, this may be body speed >0, even if wheel speed is set to 0 (this reverse also occurring), and it can judge whether this car is running. The time which has occurred simultaneously counts up all the above conditions exceeding predetermined time, and he

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PAGE 29/72 * RCVD AT 7/22/2010 4:28:19 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/34 * DNIS:2732885 * CSID:9198061690 * DURATION (mm-ss):22-02

judges that they are the abnormalities of the acceleration sensor 11 by output adherence, and is trying to emit an alarm.

[0018]Next, the abnormality detecting method by the 2nd working example of the acceleration sensor 11 is explained. In this case, the acceleration G which proofread the output of the acceleration sensor 11 is size from a' (g), (Acceleration by which output of this acceleration sensor 11 was proofread) - (car body acceleration calculated from wheel speed sensor S_1-S_4) is size from a' (g), The (highest wheel speed-minimum wheel speed) is smallness from deltaV' (km/h), If that ABS control is not performed, the body speed's V being size from v' (km/h), and such conditions continue exceeding the 2nd predetermined time simultaneously, it will be judged that abnormalities arose in the output gain or output drift of the acceleration sensor 11.

[0019]Next, these monograph affair is explained.

[0020]As shown in drawing 2, when the car 20 is running the slope, since gravitational acceleration works to this center-of-gravity G_0, though the car 20 has stopped, acceleration has already worked, but that the output G of the acceleration sensor 11 (it is hereafter considered as calibration value) considered it as size from a' (g). When it is made more than the highest angle theta expected in consideration of this point, it is equivalent to size from a' (g), and the output A of the car-body-acceleration sensor supposes that size will become from a' (g). It is because it is shown that (the car body acceleration calculated from the output-wheel speed of this acceleration sensor 11) is size, and its output gain of the acceleration sensor 11 is clearly more unusual than this a' (g) even if the car body acceleration made larger than a' (g) is the minimum 0. In order to judge whether they are furthermore right conditions, the highest wheel speed-minimum wheel speed is the same Reason as it being smallness and this mentioned above from deltaV' (km/h). It is the same in having mentioned not controlling ABS and this above. The vehicle speed V thinks that that it is size measures the above steep hills at a counter by making V (km/h) into top speed by constant-speed run, and it does not run the steep hills more than the 2nd predetermined time from v' (km/h), and is defined.

[0021]Although the case where the output of an acceleration sensor becomes a normal straight line at the time of taking car body acceleration along a horizontal axis, and taking the output of an acceleration sensor along a vertical axis, and an inclination becomes large from this so much, or it has become small is made unusual [an output gain] in this invention, Thereby, the change from zero point which is hard to permit is also detectable. These can be coped with although the abnormalities of a gain are produced from the layer short circuit of the output line of service voltage change or the acceleration sensor 11.

[0022]Could detect the abnormalities of the acceleration sensor correctly, according to the method by working example of this invention, as stated above, when having run the slope and abnormalities were produced in an acceleration sensor like before, there was a case so that this may not be made unusual, but. Also when reverse, it was, but such an incorrect check can be prevented certainly.

[0023]As mentioned above, although each working example of this invention was described, of course based on the technical conception of this invention, various modification is possible.

[0024]For example, although size and the (acceleration sensor output G-car body acceleration A) made the output G of the acceleration sensor 11 larger than a' (g) from a' (g) in an output adherence detection condition and output gain malfunction detection in the above working example, it is good also as latter >(G-A) b' (a'!=b'). That is, it may change in consideration of the attachment conditions over the conditions and the body a car

runs. .

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]Drawing 1 is a piping distribution diagram of the antiskid-control device with which the acceleration abnormality detecting method of this invention is applied.

[Drawing 2]Drawing 2 is a schematic diagram showing the situation of running the slope of the car which equipped the device.
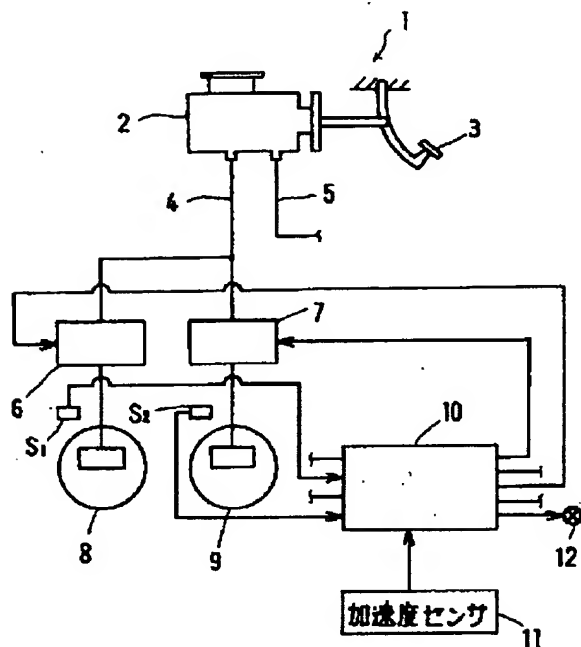
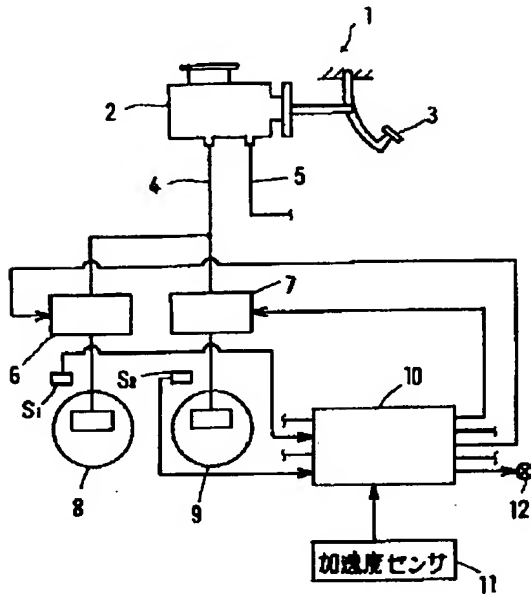[Description of Notations]

10 Control unit

11 Acceleration sensor

S_1 wheel speed sensor

S_2 wheel speed sensor

S_3 wheel speed sensor

S_4 wheel speed sensor

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JP, 08-184610, and A Representative drawing
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Drawing selection   Representative drawing
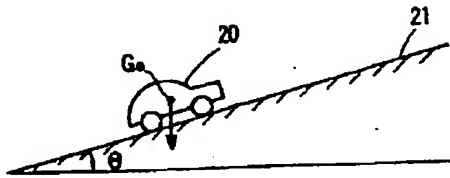

加速度センサ

[Translation done.]

Drawing selection Drawing 1

[Translation done.]

JP, 08-184610, and A [Drawing 2]

Drawing selection   Drawing 2

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